

## **APPENDIX B**

1. A method of transporting data over a synchronous digital network, said method comprising the steps of:

generating in parallel a plurality of synchronous virtual containers, each at a lower bit rate than a bit rate of said data, each said virtual container having a payload section;

associating said plurality of virtual containers with each other by means of assigning association data describing said association into said plurality of virtual containers;

inputting said transported data into said payloads of said plurality of virtual containers; and

outputting said plurality of associated virtual containers onto a synchronous digital network.

2. The method as claimed in claim 1, wherein said plurality of associated virtual containers are output onto said synchronous digital network substantially in parallel.

3. The method as claimed in claim 1, wherein said step of associating said plurality of virtual containers with each other comprises inserting said association data into a plurality of payloads of said plurality of virtual containers, said association data permitting recovery of the original association at a destination end.

4. The method as claimed in claim 1, wherein said step of inputting said transported data into said plurality of virtual containers comprises byte interleaving bytes of a frame of said transported data between said plurality of payloads.

5. The method as claimed in claim 1, wherein said plurality of virtual containers are generated as a plurality of streams of virtual containers and said step

of associating said plurality of virtual containers with each other comprises associating a plurality of said streams of virtual containers with each other.

6. The method as claimed in claim 1, wherein said plurality of virtual containers are generated as a plurality of streams of virtual containers, and said step of associating said plurality of virtual containers together by means of assigning association data comprises adding a stream of identification data to each said virtual container, said stream identification data identifying which of said plurality of streams said virtual container belongs to.

7. The method as claimed in claim 1, wherein said plurality of virtual containers are generated as a plurality of streams of virtual containers and said step of associating said plurality of virtual containers together by means of assigning association data comprises including a sequence identification data to individual ones of said plurality of virtual containers, said sequence identification data designating a sequence in which said individual virtual containers are generated with respect to each other.

8. The method as claimed in claim 7, wherein said plurality of virtual containers are generated as a plurality of streams of virtual containers and said step of associating said plurality of virtual containers together by means of assigning association data comprises assigning to individual ones of said plurality of virtual containers a sequence identification data comprising a cyclically repeating code data.

9. The method as claimed in claim 1, wherein said plurality of virtual containers are generated as a plurality of streams of virtual containers and said step of associating said plurality of virtual containers together by means of assigning association data comprises assigning to individual ones of said plurality of virtual containers a cyclically repeating code sequence having a repetition period of at least

2 N+1, where N is the repetition number of sequentially received virtual container payloads in a single stream.

10. The method as claimed in claim 1, wherein the said plurality of virtual containers are generated as a plurality of virtual container streams and said step of associating said plurality of virtual containers together by means of assigning association data comprises utilizing a path trace byte in a virtual container overhead as a stream identifier data for identifying a virtual container as belonging to a particular said virtual container stream.

11. The method as claimed in claim 1, wherein a said plurality of virtual containers are generated as a plurality of streams of virtual containers and said step of associating said plurality of virtual containers together by means of assigning association data bytes comprises including a sequence identification data in individual ones of said plurality of virtual containers, said sequence identification data designating a sequence in which said individual virtual container is generated within a said stream of virtual containers, said sequence identification data being carried within a K3 byte of an overhead section of said virtual container.

12. The method as claimed in claim 1, wherein said plurality of virtual containers are generated as a plurality of streams of virtual containers and said step of associating said plurality of virtual containers together by means of assigning association data comprises assigning to individual ones of said plurality of virtual containers a sequence identification data comprising a code data extending over a plurality of said virtual containers of a said stream, for identifying a position of each said virtual container within said virtual container stream.

13. Apparatus for incorporating data input at a first data rate into a plurality of streams of synchronous digital hierarchy virtual containers each output at a second data rate, said apparatus comprising:

means for continuously generating a plurality of virtual containers in parallel;  
means for generating data describing an association of said plurality of virtual containers, and for assigning said association data to said plurality of associated virtual containers; and  
means for inserting said first data rate data into said plurality of payloads of said plurality of virtual containers.

14. A method of recovering data from a plurality of synchronous virtual containers, said method comprising the steps of:

receiving said plurality of virtual containers;  
identifying an association data from said plurality of virtual containers, said association data indicating an association between individual ones of said plurality of virtual containers;  
reading data bytes from each payload of said plurality of associated virtual containers; and  
re-assembling said data from said plurality of read payload data bytes.

15. The method as claimed in claim 14, wherein said process of reading said data payloads comprises reading a plurality of said payloads in a byte interleaved manner.

16. The method as claimed in claim 14, wherein said step of identifying an association data from each of said plurality of virtual containers comprises reading a plurality of stream identification data from said plurality of virtual containers, said stream identification data designating which of a plurality of streams of virtual containers said virtual containers belong to.

17. The method as claimed in claim 14, wherein said step of identifying an association data between said plurality of virtual containers comprises reading a

plurality of sequence identification data designating where in a sequence of virtual containers each individual virtual container belongs.

18. The method as claimed in claim 14, wherein said step of receiving a plurality of said virtual containers comprises receiving a plurality of separate streams of associated virtual containers simultaneously.

19. The method as claimed in claim 14, wherein said step of reading data bytes from each payload of said plurality of associated virtual containers comprises reading said data bytes substantially in parallel from a plurality of virtual containers of a same sequence identification from a plurality of associated virtual container streams.

20. The method as claimed in claim 14, wherein said step of receiving a plurality of said virtual containers comprises receiving a plurality of separate streams of associated virtual containers, and said step of identifying an association data from said plurality of virtual containers comprises inspecting a path trace byte of each of a plurality of said virtual containers, and distinguishing from which of a set of said streams of virtual containers said individual virtual containers belong, from said read path trace data bytes.

21. The method as claimed in claim 14, wherein said step of receiving a plurality of virtual containers comprises receiving a plurality of separate streams of associated virtual containers, and said step of identifying an association data from said plurality of virtual containers comprises reading a plurality of sequence identification data designating where in a stream of said virtual containers, a said virtual container belongs, said sequence data being read from a K3 byte of a said virtual container.

22. A method of recovering data carried in payloads of a plurality of associated synchronous digital hierarchy virtual containers, said method comprising the steps of:

for each said virtual container:

reading data indicating an association between said virtual container and other ones of said plurality of virtual containers;

allocating a memory storage area for storing a payload of said virtual container;

inputting said virtual container payload into said memory area; and

reading said data from said memory area in parallel with data read from other said memory areas corresponding to payloads of other said virtual containers of said plurality of virtual containers.

23. The method as claimed in claim 22, wherein a said data frame is distributed between said plurality of virtual containers and said step of, for each virtual container, reading data in parallel with data of other virtual containers comprises:

for each said memory area, setting a read pointer to a memory location of said memory area;

wherein said plurality of read pointers are set to said memory locations such that successive bytes of said data frame are read from said plurality of memory locations in sequence.

24. The method as claimed in claim 22, further comprising the step of assembling said data frame from said parallel read data.

25. The method as claimed in claim 22, wherein said data frame comprises an OSI layer 2 data frame.

26. A method of recovering a data block carried in a plurality of payloads of a plurality of associated synchronous digital hierarchy virtual containers, said method comprising steps of:

receiving a plurality of streams of said plurality of associated virtual containers;

for each said received virtual container stream allocating a corresponding respective memory area for storage of data payloads of virtual containers of said stream;

storing said plurality of virtual container payloads in said corresponding allocated memory areas; and

reading individual bytes of said plurality of stored virtual container data payloads in sequence to reconstruct said data block.

27. The method as claimed in claim 26, wherein said step of reading individual bytes of said plurality of payloads comprises;

for each said memory area, setting a read pointer to a memory location corresponding to a next data byte of said data block to be read, contained within that data payload; and

reading said data byte once a preceding data byte of said data block has been read from a memory location of another said memory area.

28. The method as claimed in claim 26, wherein said step of reading individual bytes of said plurality of payloads comprises reading bytes from each of a plurality of said memory areas in which said virtual container payloads are stored.

29. Apparatus for recovering data from a plurality of synchronous digital hierarchy virtual containers containing said data, said means comprising:

a random access memory configured into a plurality of individual memory areas allocated for storage of payloads of said plurality of virtual containers;

a data processor means operating to identify an association data of said virtual containers, said association data indicating an association of said plurality of virtual containers; and

means for generating a plurality of read pointers operating to successively read a plurality of memory locations of said memory areas for recovering said data from said plurality of virtual containers.

32. A method of transporting data over a synchronous digital network, said method comprising the steps of:

generating in parallel a plurality of synchronous virtual containers, each at a lower bit rate than a bit rate of said data, each said virtual container having a payload section;

associating said plurality of virtual containers with each other by means of assigning association data describing said association into said plurality of virtual containers;

indicating for each virtual container the time at which each virtual container was generated relative to other associated virtual containers;

inputting said transported data into said payloads of said plurality of virtual containers; and outputting said plurality of associated virtual containers onto a synchronous digital network,

wherein data indicating the time at which each virtual container was generated relative to other associated virtual containers is incorporated over several virtual containers by utilizing one or more bits from each successive virtual container of an association of virtual containers.

33. A method as claimed in claim 32, wherein indicating a time at which each virtual container was generated relative to other associated virtual containers is incorporated over several virtual containers by utilizing one or more bits from the payload of each successive virtual container of an association of virtual containers.



34. A method as claimed in claim 32, wherein data indicating the time at which each virtual container was generated relative to other associated virtual containers is incorporated over several virtual containers by utilizing one or more bits from the overhead each successive virtual container of an association of virtual containers.

35. A method as claimed in claim 1, wherein each association of virtual containers is identified by a path trace byte in the overhead of each of said associated virtual containers.

36. The method as claimed in claim 1, wherein data indicating the time at which each virtual container was generated relative to other associated virtual containers is provided by a sequence marker for each virtual container, and wherein the maximum differential delay expected between virtual containers at a destination in said synchronous digital network determines the number of frames over which a sequence marker must increment before it is repeated, the sequence marker being incremented every  $2N + 1$  frames wherein  $N$  is the number of frames generated in a time equivalent to the maximum differential delay.